

*REMARKS/ARGUMENTS*

In response to the Office Action mailed October 27, 2008, Applicants amend their application and request reconsideration. The two examined claims, claims 6 and 7, are replaced by new claims 8 and 9.

New claim 8, the sole pending independent claim, is a reorganized and clarified form of claim 6. The description in the new claim 8 is fully supported by the description in the patent application at pages 8-10. The same disclosure supports claim 9.

The invention is directed to an exercise therapy device, basically described in the patent application with respect to a single-pedal shaft pulley stationary bicycle. The device is a therapy device, meaning that it rehabilitates and increases muscular strength in a user in need thereof, for example, patients with heart disease, cerebrovascular disorders, elderly patients, long-term patients with low physical strength, patients with unhealthy life habits, overweight patients, or injured athletes. The user may have weak legs and difficulty in starting rotation of the pedal shaft pulley.

The claimed invention advantageously provides such patients with a suitable pedal load for recovering and increasing muscular strength. As shown in Figure 1 of the present application, pedal rotation shaft 27 is connected to the pedal shaft pulley 22. Load motor 25 is disposed to drive rotation of the pedal rotation shaft 27. Load side pulley 24 is connected to load motor 25. Belt 23 is looped around pedal shaft pulley 22 and load side pulley 24. In load motor 25, a speed reducer (not shown) is disposed to reduce the rotating speed of load motor 25. Load side pulley 24 is coupled with load motor 25 through the speed reducer.

This structure of the exercise therapy device generates mechanical friction on the driving system, i.e., mechanical loss. Thus, when it is necessary to provide a weaker load than the mechanical loss to the exerciser, the mechanical loss would need to be subtracted from the pedal load. The claimed exercise therapy device provides a mechanism for subtracting the mechanical loss from the pedal load by using the driving force of load motor 25. Load control device 26 instructs the driving force to load motor 25. The claimed exercise therapy device advantageously solves the problem caused by error in the driving force generated by load motor 25, which could make the driving force become stronger than the mechanical friction on the driving system, and in turn cause the pedals 21 to rotate by the driving force of load motor 25, contrary to the intention of the user. Such an occurrence

would jeopardize the safety of the user, as well as fail to provide the load necessary for the user to gain benefits from the exercise.

The claimed invention solves this problem by making a judgment as to whether the pedals are being rotated by the load from the load motor 25 or by the force with which the user depresses the pedals 21. In the claimed invention, the initiation of rotation of the pedal shaft pulley by a user applying a force to pedals attached to the pedal shaft pulley is detected. That detection is made by detecting relative sag in an endless belt 23 of a transmission that couples a load motor to the rotating pedal shaft pulley. The endless belt 23 has two portions, and one of those portions will sag when the user of the therapy device begins attempting to rotate the pedal shaft pulley. Upon the detection of that sag, a load control device 26 activates the load motor to provide an assisting force to aid in the initiation of rotation of the pedal shaft pulley. Thus, essentially, very little to no force is required from the user to begin the rotation of the pedal shaft pulley.

After rotation of the pedal shaft pulley has begun, the load motor may continue to apply an assisting force. This assisting force may overwhelm the driving force applied by the user to the pedals. In that event, the sag of the endless belt will be reversed. The sag detector according to the invention, which detects the initial sag, also detects the change in sag when the assisting force of the load motor attempts to rotate the pedal shaft pulley too fast. In that event, the load control device, responding to the sag detector, stops the load motor from continuing to apply the assisting force.

The exercise therapy device according to new claim 9 includes two sag detectors: a first sag detector for detecting sag of the upper portion of the endless belt and a second sag detector for detecting sag of the lower portion of the endless belt. In this arrangement, as described in the cited pages of the specification, the sag of a part of the endless belt, relating to the lack of application of an assisting force or the excessive application of an assisting force, can be reliably detected and addressed by the load control device regardless of the direction of rotation of the pedal shaft pulley. This feature can be important with patients who may have difficulty in rotating the pedal shaft pulley in a particular direction of rotation.

For example, before the claimed exercise therapy devices are shipped from the factory, the factory staff conducts tests with respect to the load which rotates pedals 21. When the user rotates pedals 21 in the normal direction (direction B in Figure 2), and the load motor provides the load, belt 23 is tense on the upper side and sags on the lower side. On the

other hand, when pedals 21 are rotated in the normal direction by the assisting force of load motor 25, belt 23 sags on the upper side and is tense on the lower side.

As explained above, in the case where it is necessary to provide a load weaker than the mechanical loss to the user, the mechanical loss should be subtracted from the pedal load. On the other hand, in the case where it is necessary to provide a load stronger than the mechanical loss to the user, a further load should be added to the pedal load. The assisting force is generated by load motor 25. Further, a state in which pedals 21 are rotated by the driving force of load motor 25 should be avoided, since some error can be included in the driving force which is generated by load motor 25. Therefore, it is necessary to make a judgment as to whether pedals 21 are being rotated by the driving force of load motor 25 or not.

According to the test results, if the driving force of load motor 25 is so large that it is going to rotate pedals 21, it needs to be reduced. On the other hand, if the driving force of load motor 25 is small, it needs to be increased. Judgment as to whether belt 23 sags or not is conducted by determining a relative shift of position of belt 23 from a predetermined position due to any sag. When the position of belt 23 is inside of the predetermined position, it is determined that a balance has been obtained between the load from load motor 25 and the load with which the user depresses pedals 21.

Examined claims 6 and 7 were rejected as anticipated by Pennebaker et al. (U.S. Patent 4,221,275, hereinafter Pennebaker). This rejection is respectfully traversed, particularly as to new claims 8 and 9.

Pennebaker concerns a bicycle with a motor assist. An electric motor is actuated in response to an increase in tension of a drive chain coupling the pedals to the rear wheel of the bicycle. The assisting force supplied by the electric motor is applied to the front wheel of the bicycle. Apparently the force provided by the motor is withdrawn, i.e., stopped, only when the bicycle rider applies brakes. The purpose of the assisting force supplied by the motor is to aid the bicycle rider when "extra exertion is needed to propel the" bicycle, for example when climbing a hill or in the presence of a strong head wind.

Furthermore, the bicycle of Pennebaker has battery 16. Normal driving by means of pedals and driving by using battery 16 are both used. With respect to the load, drive chain 6 presses roller 26 to move the movable shaft 28 vertically. Also, sensor 36 detects the distance the movable shaft 28 moves (column 2, line 30-column 3, line 13; Figure 5).

Pennebaker cannot anticipate either of the two pending claims. Of course, to anticipate either claim, Pennebaker must describe every element of the claimed invention, arranged as in the claimed invention. Pennebaker lacks at least the load control device as described in claim 8. The load control device of Pennebaker, in response to detection of no sag, i.e., increased tension in the drive chain 6, supplies power to the assisting motor. The assisting motor does not begin the rotation of either wheel of the Pennebaker bicycle, but attempts to maintain the existing speed of rotation of the wheels. By contrast, in the invention, it is sag, not increased tension, in the endless belt that is detected. Detectors 31, 32 detect the sag of belt 23 so as to output sag detection signals to load control device 26, which controls load motor 25 to provide a load to pedals 21. The sag is detected not to maintain rotation of the pedal shaft pulley, but to aid in initiating rotation of the pedal shaft pulley. This difference prevents anticipation of claim 8 by Pennebaker.

Moreover, the presently claimed exercise therapy device differs from Pennebaker in that in the claimed exercise therapy device, a judgment is made as to whether pedals are being rotated by the force with which the exerciser depresses pedals 21 or by the load from load motor 25 based on the state of the sag of belt 23. In Pennebaker, in contrast, increased tension in the drive chain 6 is detected and power is supplied to the assisting motor.

In Pennebaker, there is no possibility that the assisting force supplied by the motor in hill climbing or in the face of a head wind should be withdrawn because the bicycle is moving faster than otherwise would be the case if only the force supplied to the pedals by the rider were effective. Reducing the assisting force or eliminating the assisting force in that circumstance is entirely contrary to the concept of Pennebaker. Pennebaker only describes reducing the assisting force when the brakes are applied. There is no description of brakes in the present patent application, and the presence of a braking element is not relevant to the invention disclosed. Therefore, because of this second difference between the load control device of claim 8 and Pennebaker, Pennebaker cannot anticipate claim 8.

Claim 9 describes an apparatus including two sag detectors. Of course, there is only a single tension detector in Pennebaker and it would be superfluous to add a second tension detector to Pennebaker. However, the second sag detector in the invention as defined by claim 9 is not superfluous. Rather, the first and second sag detectors ensure that the exercise therapy device operates as desired regardless of the direction of rotation of the pedal shaft pulley. In other words, in the invention, the pedal shaft pulley can rotate in a clockwise or a

counter clockwise direction, potentially in reaction to an infirmity of the user. By contrast, in Pennebaker the wheels of the bicycle are only intended to turn in one direction, i.e., a forward moving direction of the bicycle. While it is possible in some bicycles that both front and rear wheels can turn in a reverse direction of rotations, no one sensibly intends that the bicycle operate with the wheels rotating so that the bicycle operates in reverse. The difference with respect to the inclusion of two sag detectors and the advantage obtained, which operates regardless of the direction of rotation of the pedal shaft pulley, distinguishes claim 9 from Pennebaker. Thus, Pennebaker can neither anticipate nor suggest the invention as defined by claim 9.

Reconsideration and allowance of claims 8 and 9 are earnestly solicited.

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